Conference Report
First Annual Fuel Cell End Users Forum
Webinar Proceedings
CDRL No. A003

03 May 2011

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
03 MAY 2011	**Journal Article**	**28-04-2011 to 29-04-2011**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Conference Report First Annual Fuel Cell End Users Forum	**w56hzv-09-D-0154**
	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S) **Steven Eick**	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **U.S. Army TARDEC,6501 East Eleven Mile Rd,Warren,Mi,48397-5000**	8. PERFORMING ORGANIZATION REPORT NUMBER **#21809**
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) **U.S. Army TARDEC, 6501 East Eleven Mile Rd, Warren, Mi, 48397-5000**	10. SPONSOR/MONITOR'S ACRONYM(S) **TARDEC**
	11. SPONSOR/MONITOR'S REPORT NUMBER(S) **#21809**

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The Fuel Cell End Users Forum was established to provide a user focused venue that enables a peer-to-peer support network to exchange information and gain knowledge and experience, while accelerating the adoption of fuel cell systems. The forum allows potential, prospective and current fuel cell users to interact as a peer group in the endeavor of integrating fuel cell solutions into their environments. The forum is governed by the needs of the attending user community, and its agenda is strategically developed based on user/stakeholder feedback.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Public Release**	**9**	

Introduction

The Fuel Cell End Users Forum was established to provide a user focused venue that enables a peer-to-peer support network to exchange information and gain knowledge and experience, while accelerating the adoption of fuel cell systems. The forum allows potential, prospective and current fuel cell users to interact as a peer group in the endeavor of integrating fuel cell solutions into their environments. The forum is governed by the needs of the attending user community, and its agenda is strategically developed based on user/stakeholder feedback.

The initial focus of the forum is on the nine federal installations planned to receive hydrogen fuel cell back up power systems under the Department of Energy Fuel Cell Technologies Program.

Those nine installations include:

1. Cheyenne Mountain Air Station, CO
2. U.S. Army Aberdeen Proving Ground, MD
3. U.S. Army Fort Bragg, NC
4. U.S. Army Fort Hood, TX
5. U.S. Army National Guard, OH
6. U.S. Army Picatinny Arsenal, NJ
7. NASA Ames Research Center, CA
8. US Marine Corps Air Ground Combat Center, 29 Palms, CA
9. US Military Academy at West Point, NY

In an effort to better address the needs of the fuel cell end users, a survey was sent out to the primary points of contact at the nine locations to gauge their level of knowledge on hydrogen and fuel cells. Six of the nine installations responded to the survey. The three installations that did not respond were Cheyenne Mountain, Ohio National Guard and 29 Palms.

Based on the survey results, we found there was a general understanding of hydrogen and how fuel cells worked. However, there were very few respondents who had ever received formal hydrogen or fuel cell training. Almost all respondents indicated they would like an update on both hydrogen and fuel cells.

Based on the results from that survey, an agenda was developed for the Annual Meeting (see below).

Fuel Cell End Users Forum First Annual Meeting/Webinar
Agenda
28 April, 2011
1100-1300 EDT

1100	Welcome/Overview
1110	Codes and Standards, Mr. Carl H. Rivkin, P.E., Supervisor, Safety, Codes and Standards, NREL
1140	PEM Fuel Cell Technology Refresher, Mr. Keith A. Spitznagel, Senior VP, Marketing, LOGANEnergy Corp.
1200	Hydrogen Safety for Back-Up Power Fuel Cell Installations, Mr. Miguel Maes and Stephen Woods NASA White Sands Test Facility
1230	Back-Up Power Fuel Cell Installation-Lessons Learned, Mr. Georges Dib, Chief, Operation & Maintenance Division, Ft. Jackson Headquarters and US Army Training Center
1250	Q&A and Wrap-up

This first annual meeting was intended to provide recipients of hydrogen back-up power fuel cells with a general overview of the necessary codes and standards related to hydrogen fuel cell installations, hydrogen safety, a refresher on PEM fuel cells and lessons learned from a fellow fuel cell end user at a DoD location.

Invitations were sent out to all points of contacts at the nine federal installations and encouraged to forward to others within their organizations. We received 31 registrations, of which 20 participants called into the webinar.

There were instances where there were several people at a single location accessing the webinar. There was one representative from Aberdeen Proving Ground who joined the webinar in person at the Fuel Cell Hydrogen Energy Association Conference Room in Washington, D.C. Below is a table of participants.

Webinar Participation

	Name	Organization	Registered	Attended
1	Devon Rust	Aberdeen Proving Ground	Yes	Yes
2	Shailesh Shah	NA	Yes	Yes
3	Robert Candido	NASA-WSTF	Yes	No
4	Greg Moreland	DOE Contractor	Yes	Yes
5	Marilyn Buford	USDA	Yes	No
6	Stephen Woods*	NASA-WSTF	Yes	Yes
7	Keith McAllister	Ft. Bragg	Yes	Yes
8	Keith Spitznagel*	LOGANenergy	Yes	Yes
9	Carl Rivkin*	NREL	Yes	Yes
10	Steven Eick	TARDEC	Yes	Yes
11	Abraham Seyoum	NASA-Ames	Yes	Yes
12	Steve Hammill	CERL	Yes	Yes
13	Georges Dib*	Ft. Jackson	Yes	Yes
14	Nick Stecky	Picatinny Arsenal	Yes	Yes
15	Robert Wichert	FCHEA	Yes	Yes
16	Erin Lane	Cascade Associates	Yes	Yes
17	Nick Josefik	CERL	Yes	Yes
18	Robert Kennedy	Ft. Hood	Yes	Yes
19	Steven Polacek	West Point	Yes	Yes
20	Ron Gooch	OH National Guard	Yes	Yes
21	Bill Haris	TARDEC	Yes	Yes
22	Leo Grassilli	ONR	Yes	Yes
23	Miguel Maes*	NASA-WSTF	Yes	Yes
24	Al Sorkin	NASA-Ames	Yes	Yes
25	James Warner	FCHEA	Yes	Yes
26	Gricel Robles	Picatinny Arsenal	Yes	No
27	Karen Shilo	DOT	Yes	Yes
28	Chris Ainscough	NREL	Yes	Yes
29	Jennifer Kurtz	NREL	Yes	Yes
30	Ruth Cox	FCHEA	No	Yes
31	Rene Parker	SES	Yes	Yes
32	Pete Barkey	FCHEA	Yes	Yes
33	John Chistensen	DOE Contractor	No	Yes

* Speaker

Below is a summary of the presentations given during the webinar. Attendees were provided the opportunity to ask questions after each presentation and a summary is provided of those questions and answers.

Codes and Standards for Stationary Fuel Cells, Carl Rivkin, P.E., National Renewable Energy Laboratory

- Determining applicable codes and standards for hydrogen fuel cells used to provide back-up power
- Fuel cells that require hydrogen storage in amounts that exceed current bulk storage threshold of 400scf
- Department of Defense facilities are subject to Unified Facilities Criteria 3-600-01 Fire Protection Engineering for Facilities (UFC)
- Specific portions of the International Code Council's (ICC) International Building Code (IBC) and International Fire Code (IFC), International Fuel Gas Code (IFGC) and International Mechanical Code (IMC)
- The National Fire Code (NFC) promulgated by the National Fire Protection Association (NFPA)
    - NFPA 853 Standard for the Installation of Stationary Fuel Cell Power Systems 2010 edition/NFPA 2 Hydrogen Technologies Code 2011 edition
        - Siting
        - Fire prevention and emergency planning
        - Set back distances
- Other codes and standards American Society for Mechanical Engineers (ASME) and Compressed Gas Association (CGA)
- Discussed hydrogen code hierarchy
    - Primary building and fire codes at the top
    - Hydrogen specific codes and standards
    - Component standards that are referenced in the NFPA codes and standards
- Reference provided for the DOE Model Codes and Standards website

Questions/Answers
Question: Is the contractor installing the fuel cells responsible for meeting all codes and standards?
Answer: No, it is the responsibility of the host site. Therefore it is important that the host site understand the applicable codes and standards and are able to sign off on the design/drawings.

Question: You referred to several different written procedures, can those be written in one document?
Answer: Yes, they can be contained in one document.

Question: Do the procedures have to be posted?
Answer: Depends on the procedure. They must all be accessible.

PEM Fuel Cell Technology Refresher, Keith Spitznagel, Senior VP, Marketing, LOGANEnergy Corp.

- Discussed different fuel cell technologies and their electrolyte, operating temperature and efficiency
- Fuel cell applications (large scale stationary, small scale back-up and small scale stationary)
- How a PEM Fuel Cell works
    - Low operating temperature enables fuel cells to come on very quickly
- Principal Subsystems
    - Fuel Cell Stack
    - DC Power Conditioning
    - Electrical Energy Storage
        - Batteries are currently included within the fuel cell to allow for seamless back-up and also looking at super capacitors
    - Thermal Management System
        - Heat generated within the back-up power fuel cells is not available to be recovered
    - Insulated Cabinet
    - Fuel Storage System
- Incumbent technologies such as UPS with batteries and Diesel Gensets
- Discussed features of fuel cells and the benefits
- Discussed the various companies providing fuel cells under this program including Altergy, Hydrogenics, Ida Tech, and ReliOn
- Showed a typical system configuration
- Discussed fuel cell disadvantages

Questions/Answers

Question: How is a "system" defined and what do the codes and standards say about adjacency to other systems?
Answer: Gave the example of the IdaTech fuel cell configuration as a "system." The intent of the codes and standards for adjacency to other systems is to prevent a domino effect if there is a failure.

Question: How far should hydrogen storage be from a building?
Answer: Depends on system hydrogen pressure and type of building. Refer to the table in NFPA 2 for set-back distances. Generally the set-back is between 5 feet and 15 feet from a building.

Question: Was the system configuration shown within the slides typical?
Answer: Yes

Hydrogen Safety Considerations for Back-Up Power Fuel Cell Installations, Miguel Maes and Stephen Woods, NASA White Sands Test Facility

- Referenced their participation in the DOE Hydrogen Safety Panel
- Long history of hydrogen safety
- Hydrogen behavior
- Examined a generic system arrangement
- Concerns for installation, operation and maintenance
- Actions the user organization should pursue
    - Educate in-house facilities engineering and safety staffs about basic hydrogen requirements
    - Ensure critical personnel have sufficient in-depth training to handle any potential scenarios
    - Promote workforce awareness of the installation
    - Management, facilities and safety mush review critical operational and design input from the architect-engineering (A&E) firms
    - Ensue A&E follow standards
    - Arrange local Authority Having Jurisdiction (AHJ) review of plans
    - Coordinate details with local emergency response professionals
- Future directions-a work in progress
    - New and specific material for fuel cell back-up systems will be compiled by DOE hydrogen Safety Panel
    - Best Practices and hydrogen incident websites referenced

Questions/Answers

One of the participants indicated that they were "freaked" out by the presentation. This statement led to a discussion on the comparison of hydrogen with other fuels (such as gasoline) and the need to understand how to safely handle all fuels. The long history of the safe use of hydrogen was also restated. There was also the mention of hydrogen sensors to identify any releases of hydrogen.

Question: Will I need to establish separate safety procedures for hydrogen?
Answer: Yes, you should have separate hydrogen safety procedures.

Case Study at Fort Jackson, Georges Dib, Chief Operation and Maintenance Division

- Provided an overview of fuel cell installation at Ft. Jackson
    - 10, 5 kW PEM fuel cells installed at three critical locations for use as back-up power
    - Installed October 2009
    - 18 month testing and monitoring
    - 5 year maintenance and operation
- Lessons learned
    - Top management has to be involved
    - Establish a planning team made up of all levels of personnel including senior management

- Develop a Memorandum of Understanding
- Perform a risk assessment and business impact analysis
- 103 hours of operation on fuel cells between August 2009-August 2010
- 13 service/maintenance calls August 2009 to April 2011
- Service cost has been less than $20,000 (includes hydrogen, materials, travel and labor)
- Discussed pros and cons

Questions/Answers
Question: How fast can the fuel cells pick up load once and outage occurs?
Answer: Immediately, seamless back-up of the load when grid power goes down.

Question: How many outages have occurred?
Answer: Fuel cells have logged 103 hours of operation.

Webinar Feedback Survey
Following the webinar, participants received copies of the presentations and were asked to complete a survey about the webinar. Out of 20 webinar attendees, only five completed surveys.

The survey asked participants to evaluate the following on a scale of Very Satisfied to Very Dissatisfied:

- **Quality of information-** 2 (very satisfied), 3(somewhat satisfied)
- **Relevance of information-** 3(very satisfied), 2(somewhat satisfied)
- **Opportunity for questions/interaction-**3(very satisfied), 1(somewhat satisfied), 1 (somewhat dissatisfied)
- **Overall satisfaction with the webinar-** 3(very satisfied), 1(somewhat satisfied), 1(neither satisfied nor dissatisfied)

Participants were also asked for suggestions on additional topics they would like information on. Responses included: safety of hydrogen gas and fuel cell codes and standards.

Overall comments and suggestions provided by participants included the following:

- The segment on hydrogen safety, while technically accurate was over the heads of the intended audience. In addition, it had the effect (probably un-intended) of making hydrogen sound really scary. That talk was more appropriate for first responders, or firefighters, not for warehouse managers.
- For the next quarterly, I would suggest presentations on the host sites reps on exactly what they are backing up. There is a lot of variation as to what "critical facilities" the host sites are backing up.

Conclusion

Overall, the First Annual Fuel Cell End Users webinar went well. There is an interest in attracting more of the fire and safety personnel at the nine installations. Based on a conversation with the representative from Aberdeen, the primary barrier she faces is resistance from her safety point of contact on base. There was a discussion on how to connect her safety point of contact with another safety contact at another location to share experiences and knowledge. Another concern was the overall lack of enthusiasm and engagement of base personnel in the project. We discussed the importance of identifying a champion; preferably at the top of the chain of command to support the project.

There was also an interest in how to combine the fuel cell systems with renewable hydrogen production projects. An example provided by Aberdeen was the possible linking of a waste water treatment hydrogen production project together with the fuel cell deployment.

Next steps will include identifying installations within the group of nine that are accomplishing major milestones and request that they provide lessons learned to the group.

We will also be putting together a larger group of “champions” who can assist in providing peer to peer support for the installations coming on board.

A quarterly meeting has been tentatively scheduled to align with the fuel cell ribbon cutting at Aberdeen Proving Ground in August.